X. MONETARY COSTS OF EACH ALTERNATIVE

A. GENERAL CONSIDERATIONS[1,2,3]

Costs for the three alternative plans in undiscounted 1976 dollars were developed previously[1] for the Defense Waste Document (DWD). The costs given here are updated from those in the DWD[2] and reflect the increasingly stringent criteria being applied to both the processing and storage of nuclear wastes. Costs include research and development, capital, and operations costs. For this document, the costs for certain alternatives are estimated from a designed and costed facility for the production of a glass product. Other alternatives have been estimated from public documents and cost studies.

The costs for Alternative 1, continued tank farm operation, include an amount equal to the cost in 1980 dollars of one set of new tanks. This should be more than enough money to provide a trust fund to build new tanks every fifty years, if required, and ensures that the costs for continued tank farm operation reflect the same degree of perpetuity as costs for the other storage or disposal modes. Creation of such a trust fund would require new legislation.

The accuracy of the cost numbers varies with the knowledge of the process evaluated. The cost of continued tank storage is very well established, and values shown in this report should be quite accurate. Solidification of waste of the SRP type is an undemonstrated process. Therefore, the cost of such a process is uncertain. The costs used for the solidification processes were based on venture guidance estimates; the processing rates attainable in the solidification steps are particularly uncertain because they depend on the successful operation of many undemonstrated processes.

The costs for bedrock and geologic disposal are based on an escalation of previous studies.[1] None of these disposal concepts has been demonstrated, and costs are subject to large changes depending on the criteria developed for the disposal concepts.

B. COST CENTERS

The purpose of this study is to allow a comparison of the alternative plans. Therefore, the accuracy of the cost estimates is not as important as having consistent, comparable estimates. To achieve this consistency, a series of cost centers were developed. Then the cost of each alternative plan could be determined by summing the cost of the applicable cost centers, which are defined as follows:

1. *Removal of Waste from Tanks.* The equipment and manpower requirements necessary to provide a uniform feed supply to the processing plant were estimated. In those plans where no processing occurs, this cost center value is reduced to reflect less piping and no mixing requirement.

2. *New and Replacement Tanks.* New and replacement tank needs were determined and these tanks were costed at $12 million each.

3. *Sludge Separation and Salt Decontamination.* A waste processing facility was designed, and a detailed cost estimate was made. That fraction of the total facility that applied to sludge separation and salt decontamination was determined, and appropriate capital costs were established. Similarly, that fraction of the estimated total facility operating costs that applied to this cost center was determined. Costs applicable to both salt and glass product, such as sludge separation, were distributed to these cost centers.

4. *Return of Decontaminated Salt to Old Tanks.* Capital costs for transfer lines and new evaporators were estimated. No capital cost for tanks was included.

5. *Vitrification.* As in Cost Center 3, that fraction of the total facility applicable to producing glass product was estimated, and that fraction of the total facility capital cost and of the total operating costs were determined.

6. *Transportation.* The capital and operating costs for transportation to a geologic site were estimated. Rail transport to a site about 1500 miles away was assumed. Capital costs consist of casks; operating costs represent the charge by the railroad.

7. *Temporary Storage.* In those plans requiring transportation, a facility is provided onsite to allow for storage of 2 year's production of glass product.

8. *Onsite Surface Storage Facility for Solidified Waste Product.* Onsite surface storage of all of the glass products is an expansion of the 2-year storage facility.

9. *Bedrock Cavern Storage at SRP.* The storage of SRP wastes in the bedrock under the Savannah River Plant site has been studied for over 20 years. The costs for bedrock storage of unseparated wastes were estimated in 1969. In this present analysis, the 1969 costs were adjusted upward to allow for additional transfer lines, larger tunnels, more monitoring, and escalation. The tunnel size requirements were estimated from a thermal analysis that established an acceptable storage matrix of contained waste. Tunnel size for liquid waste was determined by the quantity of liquid being stored.

10. *Offsite Geologic Storage.* Space requirements for storage of packaged waste in geologic formations were determined by a thermal analysis. Costs for providing the required storage space were obtained by extrapolation and escalation of previous studies[1] of geologic storage, and may be different than actually required when cavern performance criteria are established.

11. *Research and Development.* A considerable research and development effort would be required to implement any change in the present method of waste management of SRP. The various plans would generally require greater research and development efforts consistent with the degree of complexity of the plan. Estimates of the research and development costs for each plan are included in the cost tables.

C. RESULTS

Cost Table for Alternative Plan 1

(Storage of Waste as Sludge and Damp Salt Cake in Underground Waste Tanks – Present SRP Waste Management Technique)

	Number of Tanks
Tanks available end CY-1984	27
Tanks required for normal operation	30
New tanks required	3
Replacement tanks required (every 50 years)[a]	20

	Million 1980 Dollars
Capital Cost	
New tanks	35
Replacement tanks	240
Waste removal equipment	115
Total Capital	390
Operating Costs	
Tank replacement	95
Surveillance	25
Total Operating	120
Total Plan Costs	510

a. One tank replacement will provide for 100 years total storage; about the same storage time as provided by a surface storage facility. Replacement of either tanks or the surface storage facility after 100 years would require only a very small annuity that would not significantly affect the cost of these plans. Discounting would further reduce costs of this plan compared to the alternatives since replacement tank costs are delayed 50 years.

Cost Table for Alternative Plan 2 — Subcase 1

(Glass Product Disposed of in Offsite Geologic Storage and Decontaminated Salt Cake Stored in Onsite Underground Waste Tanks, million 1980 dollars)

	Capital Cost	*Campaign Operating Cost*	*Container Cost*	*Total Campaign Cost*
Removal of waste from tanks	145	95	-	240
Salt decontamination	1065	315	-	1380
Vitrification	820	325	-	1145
Return salt to tank	45	25	-	70
Waste tanks	75	-	-	75
Temporary storage - glass	80	30	-	110
Geologic storage	150	50	140	340
Transportation - glass	20	50	-	70
Research and development	20	150	-	170
Total	2420	1040	140	3600

Cost Table for Alternative Plan 2 — Subcase 2

(Glass Product Stored in Onsite Surface Storage Facility and Decontaminated Salt Cake Returned to Onsite Underground Waste Tanks, million 1980 dollars)

	Capital Cost	*Campaign Operating Cost*	*Container Cost*	*Total Campaign Cost*
Removal of waste from tanks	145	95	-	240
Salt decontamination	1065	315	-	1380
Vitrification	820	325	-	1145
Return salt to tanks	45	25	-	70
Waste tanks	75	-	-	75
Storage for glass	450	80	140	670
Research and development	20	150	-	170
Total	2620	990	140	3750

Cost Table for Alternative Plan 2 — Subcase 3

(Glass Product Disposed of in SRP Bedrock and Decontaminated Salt Cake Stored in Onsite Underground Waste Tanks, million 1980 dollars)

	Capital Cost	*Campaign Operating Cost*	*Container Cost*	*Total Campaign Cost*
Removal of waste from tanks	145	95	-	240
Salt decontamination	1065	315	-	1380
Vitrification	820	325	-	1145
Return salt to tanks	45	25	-	70
Waste tanks	75	-	-	75
Bedrock cavern - glass	290	100	140	530
Research and development	20	150	-	120
Total	2460	1010	140	3610

Cost Table for Alternative Plan 3

(Unprocessed Waste Slurry Disposed of in SRP Bedrock, million 1980 dollars)

	Capital Cost	*Campaign Operating Cost*	*Container Cost*	*Total Campaign Cost*
Removal of waste from tanks	145	95	-	240
Bedrock cavern	380	60	-	440
Research and development	10	65	-	75
Total	535	220	-	755

D. REFERENCES FOR SECTION X.

1. *Alternative Plans for Storage of High Level Waste — Flowsheets and Cost.* Memorandum to J. M. Boswell, Internal Report DPST-76-95-17, Savannah River Laboratory, E. I. du Pont de Nemours and Co., Aiken, SC (May 5, 1976).

2. *Alternatives for Long-Term Management of Defense High-Level Radioactive Waste, Savannah River Plant, Aiken, South Carolina.* Report ERDA-77-42/1, Energy Research and Development Administration (May 1977).

3. E. L. Graf. *Capital and Operating Costs for Defense Waste Processing Facility.* Internal Report DPSP-79-1020, Savannah River Plant, E. I. du Pont de Nemours and Co., Aiken, SC (March 1979).